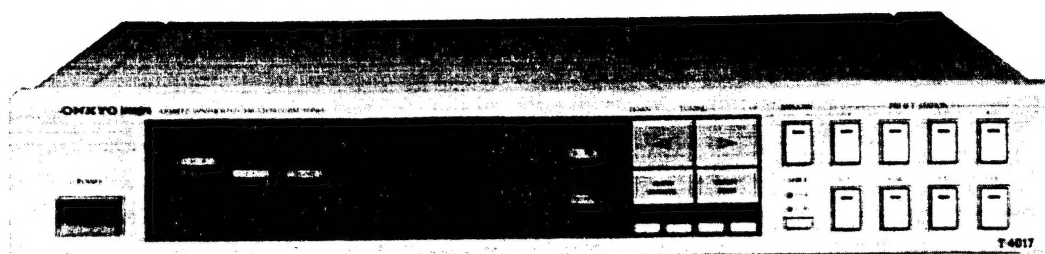


ONKYO® SERVICE MANUAL

SYNTHESIZED FM/AM STEREO TUNER MODEL T-4017



UD, UDN, BUD, BUDN	120V AC, 60Hz
UG, UGV, BUG, BUGV	220V AC, 50Hz
UW	120 or 220V AC, 50/60Hz

SAFETY-RELATED COMPONENT WARNING!!

COMPONENTS IDENTIFIED BY MARK Δ ON THE SCHEMATIC DIAGRAM AND IN THE PARTS LIST ARE CRITICAL FOR RISK OF FIRE AND ELECTRIC SHOCK. REPLACE THESE COMPONENTS WITH ONKYO PARTS WHOSE PART NUMBERS APPEAR AS SHOWN IN THIS MANUAL.

MAKE LEAKAGE-CURRENT OR RESISTANCE MEASUREMENTS TO DETERMINE THAT EXPOSED PARTS ARE ACCEPTABLY INSULATED FROM THE SUPPLY CIRCUIT BEFORE RETURNING THE APPLIANCE TO THE CUSTOMER.

SPECIFICATIONS

— D model —

FM:

Tuning Range:	87.9 – 107.9 MHz (200 kHz steps)
Usable Sensitivity:	Mono: 10.3 dBf, 1.8 μ V, IHF Stereo: 17.2 dBf, 4.0 μ V
50 dB Quieting Sensitivity:	Mono: 14.7 dBf, 3.0 μ V Stereo: 36.0 dBf, 35 μ V
Capture Ratio:	1.0 dB
Image Rejection Ratio:	80 dB
IF Rejection Ratio:	100 dB
Signal-to-Noise Ratio:	Mono: 81 dB Stereo: 73 dB
Alternate Channel Att:	80 dB IHF (\pm 400 kHz) (Narrow)
AM Suppression Ratio:	55 dB
Total Harmonic Distortion:	Mono: 0.05% (wide) Stereo: 0.1% (Wide)
Frequency Response:	30 – 15,000 Hz +0.5 dB, –1.5 dB
Stereo Separation:	45 dB at 1kHz 33 dB at 70 – 10,000 Hz
Output Voltage:	0 – 1.5 V
Muting Level:	17.2 dBf, 4.0 μ V

(Continued ON next page)

ONKYO
AUDIO COMPONENTS

AM:		Selectivity: 70 dB DIN (± 300 kHz, 40 kHz dev.) (Narrow)	
Tuning Range:	530 – 1620 kHz (10 kHz steps)	AM Suppression Ratio:	55 dB
Usable Sensitivity:	25 μ V	Total Harmonic Distortion:	Mono: 0.05% (Wide) Stereo: 0.1% (Wide)
Image Rejection Ratio:	40 dB	Frequency Response:	30 – 15,000 Hz ± 0.5 dB, –1.5 dB
IF Rejection Ratio:	40 dB	Stereo Separation:	45 dB at 1 kHz 33 dB at 70 – 10,000 Hz
Signal-to-Noise Ratio:	40 dB	Output Voltage:	0 – 1.5 V
Total Harmonic Distortion:	0.7 %	Muting Level:	17.2 dBf, 4.0 μ V
Output Voltage:	0 – 500 mV		
General		AM:	
Antennas:	FM: 300 ohms balanced and 75 ohms unbalanced AM: Built-in loop antenna and external terminal	Tuning Range:	522 – 1611 kHz (9 kHz steps)
Semiconductors:	FETs: 4 TR: 59 ICs: 16 Diodes: 72 LEDs: 25	Usable Sensitivity:	25 μ V
Dimensions:	435(W) \times 77(H) \times 373(D) mm (17-1/8" \times 3" \times 14-3/4")	Image Rejection Ratio:	40 dB
Weight:	4.8 kg., 10.6 lbs.	IF Rejection Ratio:	40 dB
		Signal-to-Noise Ratio:	40 dB
		Total Harmonic Distortion:	0.7 %
		Output Voltage:	0 – 500 mV
– G/W models –		General	
FM:		Antennas:	AM: 300 ohms balanced and 75 ohms unbalanced AM: Built-in loop antenna and external terminal
Tuning Range:	87.5 – 108.0 MHz (50 kHz steps)	Semiconductors:	FETs: 6 TR: 59 ICs: 16 Diodes: 72 LEDs: 25
Usable Sensitivity:	Mono: 10.3 dBf, 1.8 μ V, IHF Stereo: 17.2 dBf, 4.0 μ V	Dimensions:	435(W) \times 77(H) \times 373(D) mm (17-1/8" \times 3" \times 14-3/4")
50 dB Quieting Sensitivity:	Mono: 14.7 dBf, 3.0 μ V Stereo: 36.0 dBf, 35 μ V	Weight:	4.8 kg., 10.6 lbs.
Capture Ratio:	1.0 dB	Specifications and features are subject to change without notice.	
Image Rejection Ratio:	100 dB		
IF Rejection Ratio:	100 dB		
Signal-to-Noise Ratio:	Mono: 81 dB Stereo: 73 dB		

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SERVICE PROCEDURES

1. Replacing the lamps

This unit uses the lamps listed below.

circuit no.	parts no.	description
PL901	210149	PL14V 0.06AW-3.0, Power indicator
PL902	210064A	PL6.3V 250mA, dial plate illumination

Caution; Before replacing the lamps, be sure to unplug the power supply cable.

2. Insulation resistance measurement

Connect the insulating-resistance tester between the plug of power supply cable and the screw on the back panel as shown Fig. 1.

Specifications; D model 500V, $3.3 \pm 0.3M\Omega$
G/W models 500V, more than $10M\Omega$

3. Handling the CMOS IC

This unit uses the CMOS ICs of Q404, Q418, Q707, Q708 and Q712.

- All MOS devices should be store transported in materials that are somewhat conductive. MOS devices must not be inserted into conventional plastic "snow" or plastic trays.
- All MOS devices should be placed on a grounded bench surface and operators should ground themselves prior to handling devices, since a worker can be statically charged with respect to the bench surface.
- Nylon clothing should not be worn while handling MOS circuit.
- When lead straightening or hand soldering is necessary, provide ground straps for the apparatus used.
- Double check test equipment setup for proper polarity of voltage before conducting parametric or functional testing.
- All unused device inputs should be connected to V_{DD} or V_{SS} (Ground).

4. Change of AM scan step

W models are equipped with a switch to change the AM scan step frequency from 9kHz to 10kHz. This switch is located on the bottom board. This switch is set to 9kHz at the factory; change to 10kHz if gives better results in your locality.

5. Change of De-emphasis

W models are equipped with a 50 μ sec-75 μ sec selector switch. This switch is located on the bottom board. This switch is set to 50 μ sec at the factory, but may have to be reset to 75 μ sec depending on the area where the unit is used.

Europe: 50 μ sec

U.S.A.: 75 μ sec

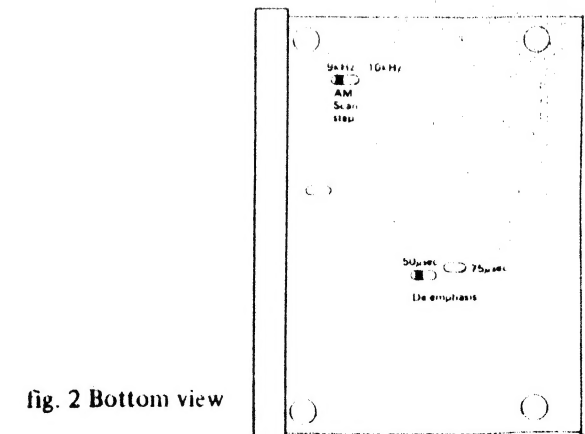
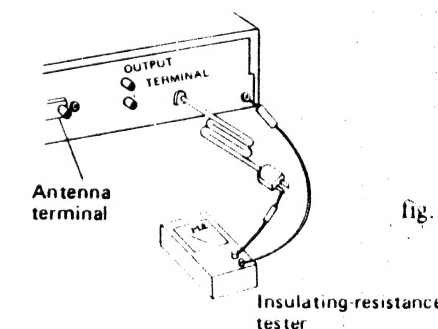
6. Change of voltage

W models are equipped with a voltage selector to conform with local power supplies. This switch is located on the back panel. Be sure to set this switch to match the voltage of the power supply in your area before turning the power switch on.

This switch is set to 220V at the factory. Voltage is changed by sliding the groove in the switch with the screwdriver to the right or left. Confirm that the switch has been moved all the way to the right or left before turning the power switch on.

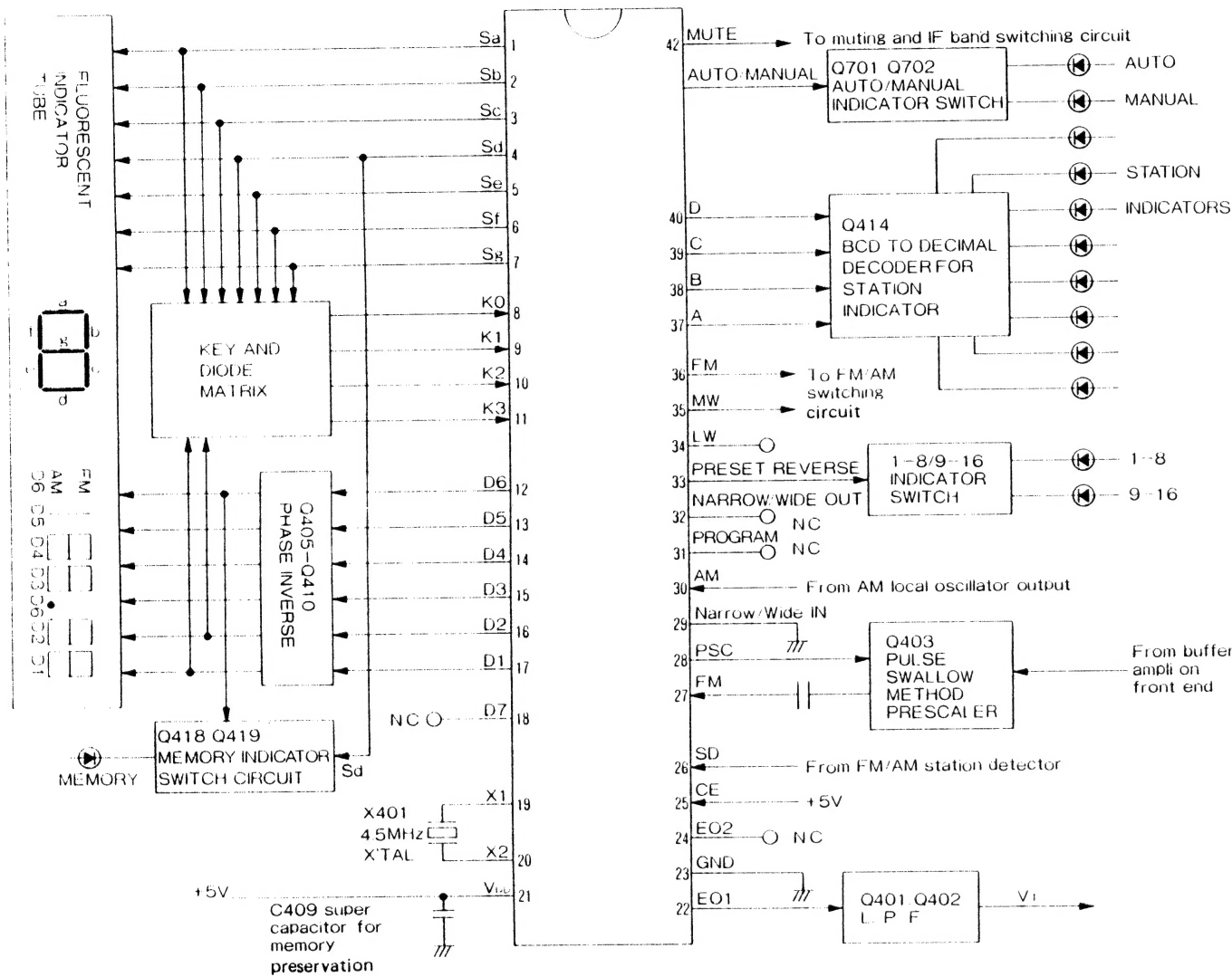
7. Memory Preservation

This unit does not require memory preservation batteries. A built-in memory power back-up system preserves contents of the memory during power failures and even when the unit is unplugged. The unit must be plugged in and the power switch turned on and off once in order to charge the back-up system. Note that since this is not a permanent memory, the power switch must be turned on and off a few times each month to keep the back-up system operable. The period of time during which memory contents are preserved after power has last been turned off varies depending on climate and the location and placement of the unit. On the average, memory contents are protected over a period of 3 to 4 weeks (a minimum of 2 weeks) after the last time power has been turned off. This period is shorter when the unit is exposed to very high humidity or used in an area with an extremely humid climate.



CIRCUIT DESCRIPTIONS

1. Synthesizer and controller description



Pin No.	Symbol	Terminal	Description
1 - 7	Sa - Sg	Segment outputs	Display tube signal terminal output and key return signal source terminals; active high. Since these terminals can handle 30V, they are connected directly to the segment terminals of the fluorescent display tube.
8 - 11	K0 - K3	Key return signal inputs	Terminals for input of the key return signals from external matrix circuit. See page 6.
12 - 18	D1 - D7	Digit outputs	Display tube digit output signal terminals; active low. D1 and D2 are used the key return signal source. See page 6.
19, 20	X1, X2	X'tal	Connect to the 4.5MHz crystal oscillator.
21	VDD	Power source input	Device power source terminal; supplies 5V during normal operation and 2.5V from the super capacitor C409 for memory preservation.

Pin No.	Symbol	Terminal	Description
22, 24	E01, E02	Error outputs	Charge pump output of the phase detector with constitutes the PLL. High level is output when the divided oscillation frequency is higher than the reference frequency. In the opposite case, low level is output. Floating occurs when the frequencies match. The output is applied to the variable capacitor diode in the front end through the low pass filter Q401 and Q402. The output from both terminals is same, but only E01 is used.
23	GND	Ground	
25	CE	Chip enable	Device selection signal input terminal. High level ... Normal operation Low level ... Memory preservation
26	SD	Station detector signal input	Input terminal for detecting whether or not a broadcast signal is being received during auto-tuning. Stopped by the high level.
27	FM	FM local oscillator signal input	Input terminal for FM local oscillator is divided by 1/16 or 1/17 by prescaler Q403.
28	PSC	Pulse swallow control output	This terminal outputs a signal that switches the prescaler division ratio of Q403 to 1/16 or 1/17 when the pulse swallow method is used for division. (FM only)
29	NARROW/Wide out	IF band width output	Terminal for switching narrow and wide of IF band width. Not used.
30	AM	AM local oscillator signal input	Terminal for input of the AM local oscillator signal.
31	PROGRAM	Program selection signal output	Terminal for indicator output whether or not the program mode. Not used.
32	NARROW/Wide out	IF band width switching output	Terminal for specifications output of IF band width. Not used.
33	Preset Reverse	Preset reverse indication output	Terminal for indication output whether M1 - M8 or M9 - M16 the preset key.
34	LW	Band switching signal outputs	Terminals for signal output switching of each band. High level is output from terminal of FM (pin no. 36) and low level is output from other terminals (pin no. 34 & 35) during FM reception. LW is not used with T-4017.
35	MW		
36	FM		
37 38 39 40	A B C D	Preset station indication outputs	Terminals for BCD code output of preset station indicator. See page 7.
41	AUTO/MANUAL	Auto/Manual indication output	Terminal for indication output whether or auto the tuning mode. This terminal becomes high during auto mode and low during manual mode.
42	MUTE	Muting output	Output terminal which mutes the shock noise occurring when the PLL is released; active high. The muting signal is output as shown below. UP/DOWN of manual/auto mode, preset memory is recalled, band switching and preset scan.

2. Diode and key matrix connection

Input Output	K3 (11)	K2 (10)	K1 (9)	K0 (8)	Remarks
Sa (1)	M1/M9	M2/M10	M3/M11	M4/M12	Segment output
Sb (2)	M5/M13	M6/M14	M7/M15	M8/M16	
Sc (3)	M17/M18 (N. U)	M19/M20 (N. U)	PRESET SCAN		Momentary switch
Sd (4)	FM	MW	LW (N. U)	PRESET REVERSE	
Se (5)	UP	DOWN	MEMORY	AUTO MEMORY (N. U)	Key input
Sf (6)	WIDE/NARROW (N. U)	PROGRAM (N. U)	DISPLAY (N. U)	AUTO/MANUAL	
Sg (7)	IF0	IF1	9N/9N+2	10kHz/9kHz	Output Input :1 :0
D1 (17)	STATIC/DYNA	BAND 2	BAND 1	BAND 0	
D2 (16)			PRESET 1	PRESET 0	

Table 1. Matrix connection

(N. U): not used with T-4017. (): terminal no.

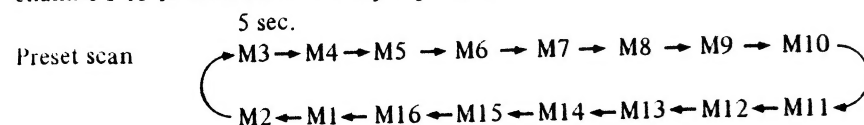
1) Diode matrix

1) Diode matrix

Mark	Description																								
IF1 IF0	IF offset value setting for FM. <table><tr><th>IF1</th><th>IF0</th><th>IF offset value</th></tr><tr><td>0</td><td>0</td><td>+10.700MHz</td></tr><tr><td>0</td><td>1</td><td>+10.725MHz</td></tr><tr><td>1</td><td>0</td><td>+10.650MHz</td></tr><tr><td>1</td><td>1</td><td>+10.675MHz</td></tr></table>	IF1	IF0	IF offset value	0	0	+10.700MHz	0	1	+10.725MHz	1	0	+10.650MHz	1	1	+10.675MHz									
IF1	IF0	IF offset value																							
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1	0	+10.650MHz																							
1	1	+10.675MHz																							
BAND 2 BAND 1 BAND 0	Geographical FM band setting. <table><tr><th>BAND2</th><th>BAND1</th><th>BAND0</th><th>Region</th><th>Frequency range</th><th>Channel space</th></tr><tr><td>0</td><td>0</td><td>1</td><td>U.S.A.</td><td>87.9 – 107.9 MHz</td><td>200kHz</td></tr><tr><td>0</td><td>1</td><td>0</td><td>Europe</td><td>87.50 – 108.00MHz</td><td>50kHz</td></tr><tr><td>0</td><td>0</td><td>0</td><td>Japan</td><td>76.1 – 89.9 MHz</td><td>100kHz</td></tr></table>	BAND2	BAND1	BAND0	Region	Frequency range	Channel space	0	0	1	U.S.A.	87.9 – 107.9 MHz	200kHz	0	1	0	Europe	87.50 – 108.00MHz	50kHz	0	0	0	Japan	76.1 – 89.9 MHz	100kHz
BAND2	BAND1	BAND0	Region	Frequency range	Channel space																				
0	0	1	U.S.A.	87.9 – 107.9 MHz	200kHz																				
0	1	0	Europe	87.50 – 108.00MHz	50kHz																				
0	0	0	Japan	76.1 – 89.9 MHz	100kHz																				
10kHz/9kHz	Channel space, reference frequency and frequency range setting for MW. <table><tr><th>10kHz/9kHz</th><th>Frequency range</th><th>Channel space</th><th>Reference frequency</th></tr><tr><td>0</td><td>522 – 1,611 kHz</td><td>9 kHz</td><td>9 kHz</td></tr><tr><td>1</td><td>530 – 1,620 kHz</td><td>10 kHz</td><td>10 kHz</td></tr></table>	10kHz/9kHz	Frequency range	Channel space	Reference frequency	0	522 – 1,611 kHz	9 kHz	9 kHz	1	530 – 1,620 kHz	10 kHz	10 kHz												
10kHz/9kHz	Frequency range	Channel space	Reference frequency																						
0	522 – 1,611 kHz	9 kHz	9 kHz																						
1	530 – 1,620 kHz	10 kHz	10 kHz																						
9N/9N+2	Frequency range setting for LW. Not used.																								
PRESET 1 PRESET 0	Preset memory station number setting. <table><tr><th>PRESET 1</th><th>PRESET 0</th><th>Preset memory number</th></tr><tr><td>0</td><td>0</td><td>10 keys (M1-M8, M17, M19/M9-M16, M18, M20) ... 20 stations</td></tr><tr><td>0</td><td>1</td><td>8 keys (M1-M8/M9-M16) ... 16 stations (use with T-4017)</td></tr><tr><td>1</td><td>0</td><td>7 keys (M1-M7/M9-M15) ... 14 stations</td></tr><tr><td>1</td><td>1</td><td>6 keys (M1-M6/M9-M14) ... 12 stations</td></tr></table>	PRESET 1	PRESET 0	Preset memory number	0	0	10 keys (M1-M8, M17, M19/M9-M16, M18, M20) ... 20 stations	0	1	8 keys (M1-M8/M9-M16) ... 16 stations (use with T-4017)	1	0	7 keys (M1-M7/M9-M15) ... 14 stations	1	1	6 keys (M1-M6/M9-M14) ... 12 stations									
PRESET 1	PRESET 0	Preset memory number																							
0	0	10 keys (M1-M8, M17, M19/M9-M16, M18, M20) ... 20 stations																							
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1	0	7 keys (M1-M7/M9-M15) ... 14 stations																							
1	1	6 keys (M1-M6/M9-M14) ... 12 stations																							

2) Preset key

When this key is pressed, each station in the memory will be turned in successively for about 5 seconds in order from channel 1 to 16 until the other key is pressed.



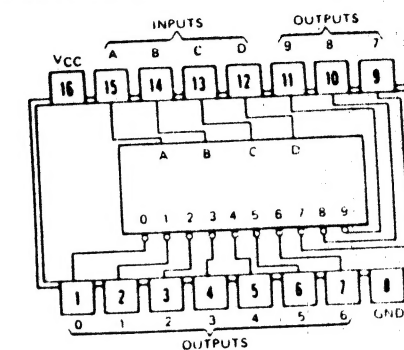
3. Indicator circuit

1) Station indication circuit

The BCD code for preset station indicator are output from terminals 37 to 40 (A to D).

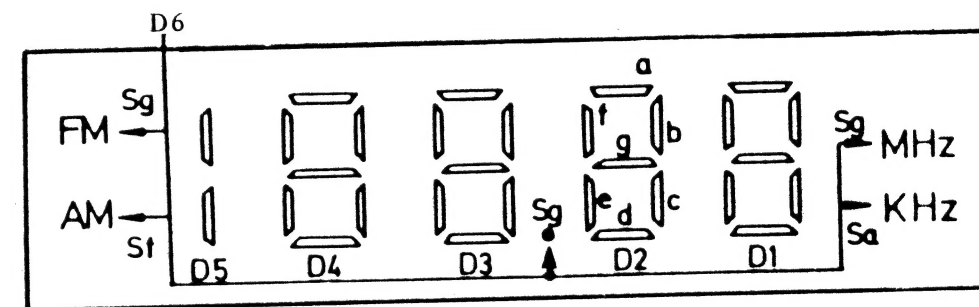
	INPUT				OUTPUT							
	D	C	B	A	2	3	4	5	6	7	9	10
M1/M9	0	0	0	1	0	1	1	1	1	1	1	1
M2/M10	0	0	1	0	1	0	1	1	1	1	1	1
M3/M11	0	0	1	1	1	1	0	1	1	1	1	1
M4/M12	0	1	0	0	1	1	1	0	1	1	1	1
M5/M13	0	1	0	1	1	1	1	1	0	1	1	1
M6/M14	0	1	1	0	1	1	1	1	1	0	1	1
M7/M15	0	1	1	1	1	1	1	1	1	1	0	1
M8/M16	1	0	0	0	1	1	1	1	1	1	1	0

● 74LS42 (BCD to decimal decoder)

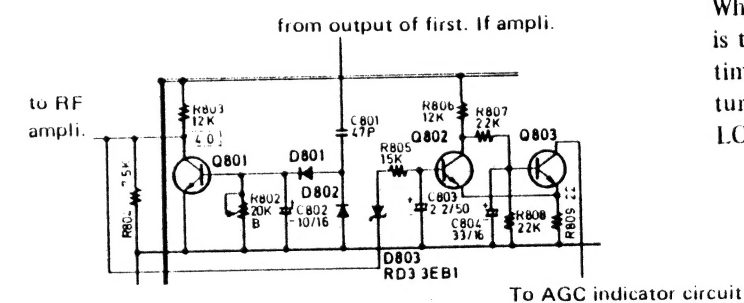


Pin Connection Diagram

2) Fluorescent display tube connection

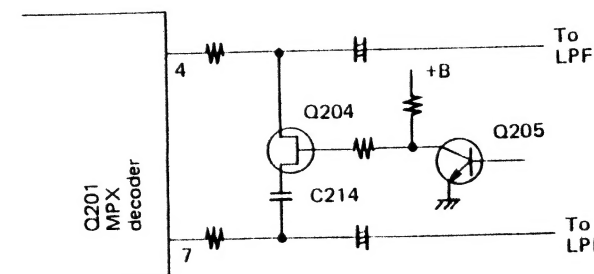


4. AGC circuit



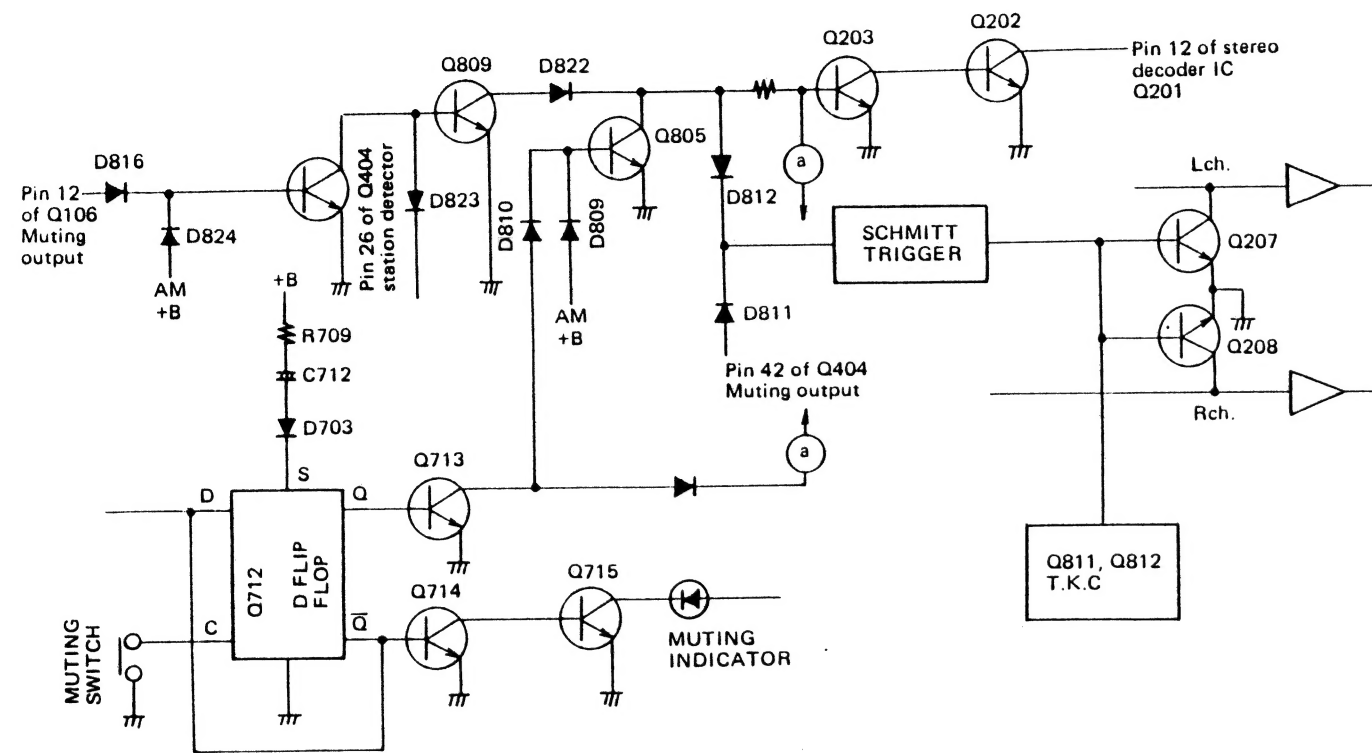
When the broadcast station is received over 85dBf, Q801 is turned on and the AGC circuit operates. At the same time, Q802 is turned off, Q803 is turned on, Q705 is turned off and, the DX indicator lights off and the LOCAL indicator lights.

5. Auto high blend circuit



There is a 3-stage IF level detection circuit in the IC of Q106. A direct current voltage approximately proportional to the electrical field intensity is output from output pin 13. This is used to turn off Q205 and turn on Q204 when the electrical field is weak (less than 40dBf) and, making use of the fact that the phase of noise component in the high range of stereo broadcast is reversed left-right, the left and right channels are mixed in the high range to reduce noise.

6. Muting circuit



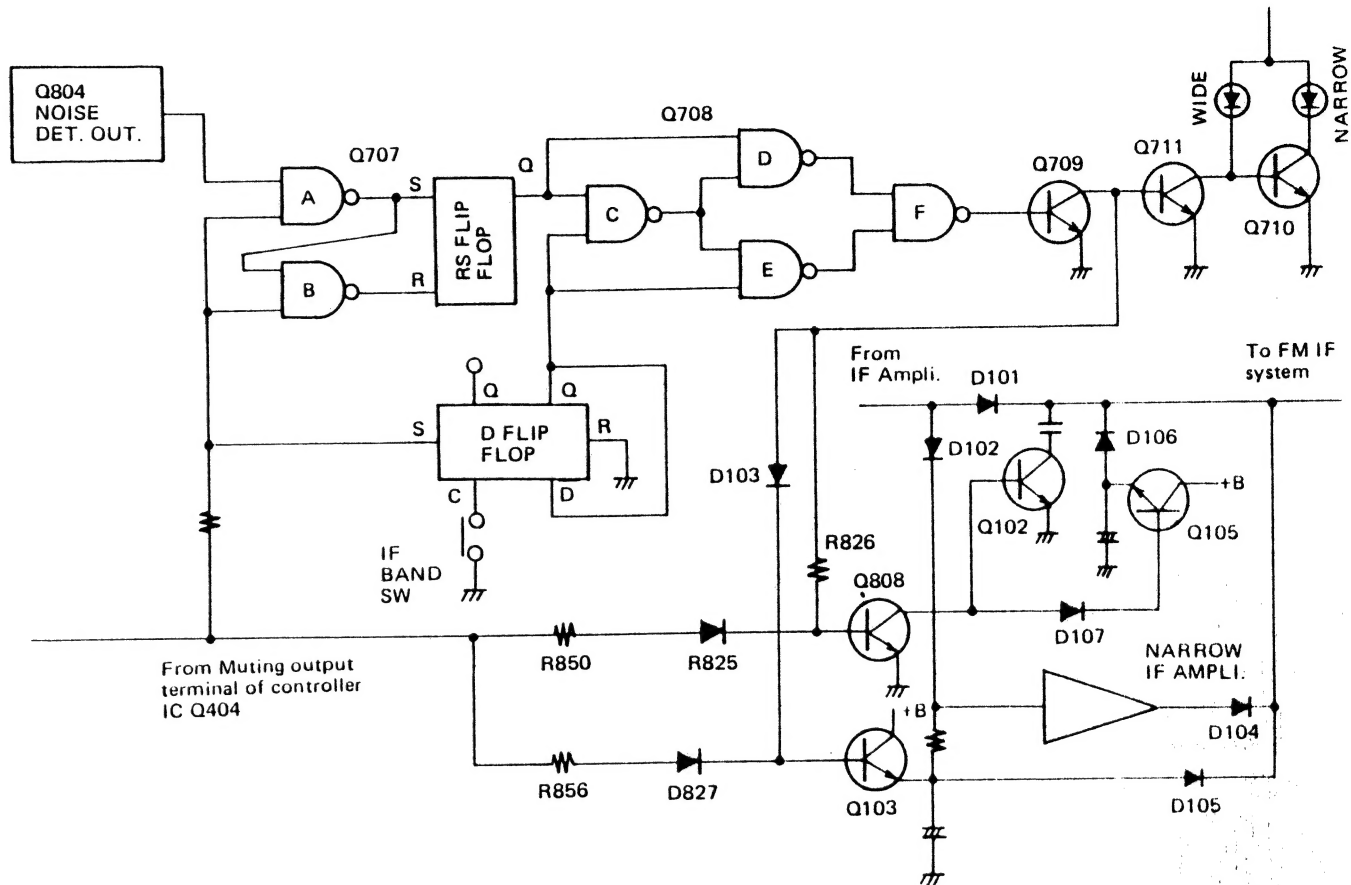
- The muting circuit operates in the following case.
1. When power is turned on, the charge current goes from +B to R837 to C815, so Q811 is cut off and Q207 and Q208 are turned on. When the voltage at both ends of C815 is more than about 0.6V, Q811 is turned on so Q207 and Q208 are turned off and muting is opened when a station is tuned.
 2. When power is turned off, Q812 turns off, the discharging current goes from C816 to D819 to Q207 and Q208 so muting is closed.
 3. While pin 42 of the controller LSI outputs the high level, Q207 and Q208 are turned on and muting is closed in the following cases: (1) While the manual UP/DOWN is being held down, (2) When a station in the memory is recalled, and (3) While a radio station is being received using auto search tuning.
 4. When an FM station is not being received (and the muting switch is on).

The IF level in the FM IF system (set at R133 so muting is opened at 17dBf) and zero cross detection circuit (tuning point $\pm 45\text{kHz}$) are output at pin 12 through the AND circuit. When a station is tuned, the output goes to the low level. When muting output goes to the low level, Q810 is turned off, Q809 is turned on, Q806 is turned off, Q807 is turned on and Q207 and Q208 are turned off, so muting is opened.

Muting switching circuit

The D flip-flop is used in the muting switching circuit. When power is turned on, the charge current goes from +B to R719 to C712 to D703, so the set terminal pin 6 of D flip-flop of Q712 goes to high level and the output terminal Q of Q712 goes to high level and \bar{Q} of Q712 goes to low level. The terminal Q of Q712 goes to the high level so Q713 is turned on, Q805 is turned off and the muting circuit operates. At the same time, the terminal \bar{Q} goes to the low level so Q714 is turned off, Q715 is turned on and the MUTE/MODE indicator LED lights. When the MUTE/MODE switch is pushed, the outputs of D flip-flop are inverted so the transistors listed above operate in the opposite manner so the indicator lights off and the input of Schmitt trigger goes to high level so the output of Schmitt trigger goes to the high level to turn on Q207 and Q208 and muting is opened.

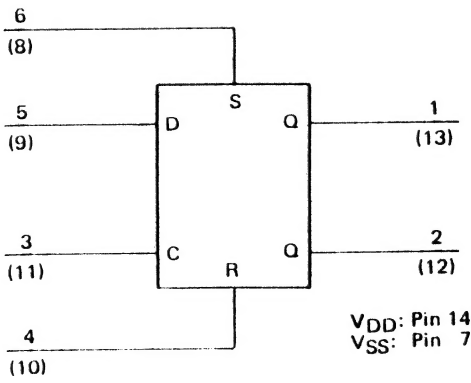
7. IF band width switching circuit



The IF band auto switching circuit is operated by the noise amplifier. When the noise components over 200kHz in the composite signal are included, the output of noise amplifier goes to the high level. When power is turned, the high level pulse is output from muting output pin 42 of controller IC Q404 and the output \bar{Q} of D flip-flop goes to the low level. When the station is tuned (when the output of noise amplifier goes to the low level), the output of RS flip-flop goes to the low level and the output of NAND gate F of Q708 goes to the low level so Q709 is turned

off, Q711 is turned on, Q710 is turned off and the WIDE indicator LED lights. At the same time, Q808 is turned on, Q102 and Q105 is turned off, Q103 is turned on and the IF amplifier goes to the wide mode. When the IF band switch is pushed or auto/manual tuning is operated (when the output of noise amplifier goes to the high level), the output of NAND gate F is inverted and the transistors listed above operate in the opposite manner so the IF band is turned the narrow operation.

4013B (Dual "D" Flip-Flop with Set/Reset Capability)

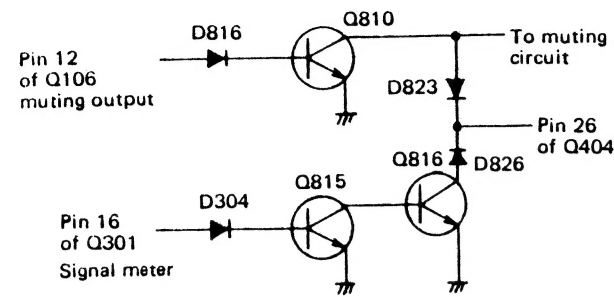


Truth table

CLOCK ⁺	INPUTS			OUTPUTS	
	DATA	RESET	SET	Q	Q ⁻
0	0	0	0	0	1
1	1	0	0	1	0
X	X	0	0	Q	Q
X	X	1	0	0	1
X	X	0	1	1	0
X	X	1	1	1	1

X = Don't Care
+ = Level change

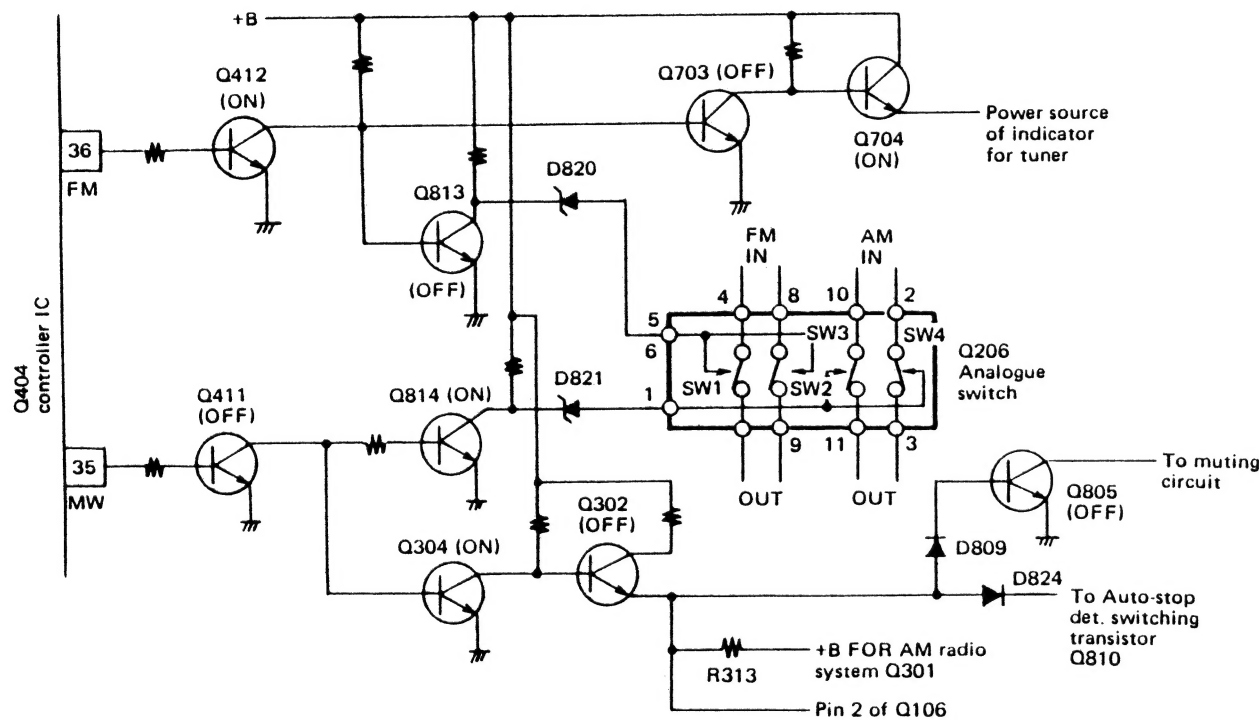
8. Station detection circuit



During FM reception, this is operated by the IF level detection (over 23dBf) and zero cross detection circuits included in the FM IF system IC of Q106. When a station is tuned, the muting output pin 12 of Q106 goes to the low level so Q810 goes from on to off, causing pin 28 of the controller IC to go to the high level to complete auto search tuning.

During AM reception, this is operated by the output of signal meter driver included in the AM radio system IC of Q301. When a station is tuned, the meter output pin 16 of Q108 go to the high level so Q815 is turned on and Q816 is turned off, causing pin 28 of the controller IC to go to the high level to complete auto search tuning.

9. FM/AM switching circuit

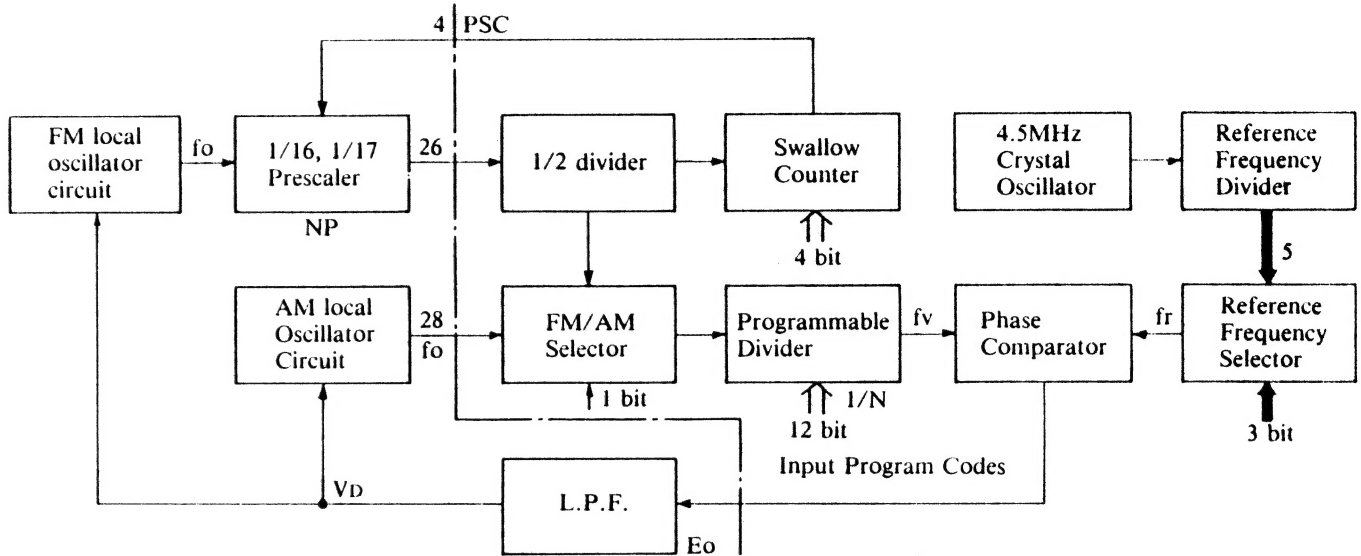


The AM/FM switching circuit is shown in the above diagram. Pins 35 and 36 of Q404 are of the mutual reset type. For FM reception, pin 36 is high and pin 35 is low; for AM, pin 36 is low and pin 35 is high. Because pin 35 is high and pin 36 is low during AM reception, Q411 is on, Q814 is off, Q412 is off and Q813 is on, the analogue switches SW3 and SW4 of Q206 are on while SW1 and SW2 are off, so an AM signal output. Also, since Q703 goes to on and Q704 to off, the muting, IF band, mode and AGC indicators are turned off. At the same time, Q304 is turned off and Q302 is turned on, So +B is

supplied to the power source terminals pin 8 & 14 of the AM radio system of Q302. The pin 2 of Q106 goes to the high level so the FM IF amplifier is also switched off.

Also, during AM reception, Q805 is turned on so the muting circuit is off and Q810 is turned on so the FM station detection circuit is off. During FM reception, all of the switching transistors mentioned above perform the opposite operations to the FM mode. Figures in parentheses indicate transistor operation during FM reception.

10. PLL tuned circuit



A block diagram of the tuned circuit of the PLL is shown above the diagram.

Operation During AM Reception

The reception frequency is applied to the programmable divider where it is divided to $1/N$ and output as f_v . This is applied to the phase detector where it is compared with frequency standard f_r (9kHz for G/W model and 10 kHz for D model). If f_r and f_v differ, E_o equal to the difference in frequency is output. Since error output E_o is a pulse waveform, it is passed through the low pass filter to change it into DC voltage V_D , which is applied to the variable capacitor in the front end to change the reception frequency. This continues until f_v and f_r are the same and $E_o = 0$.

(G/W models)

Since AM signals received range from 522 kHz to 1611kHz, they are changed to 972kHz–2061kHz for reception. Furthermore, since $f_v = f_o/N$, the divisor, N , is changed by program code input so that $N = 972/9 - 2061/9 = 108 - 229$.

(D model)

Since AM signals received range from 530kHz to 1620kHz, they are changed to 980kHz–2070kHz for reception.

Furthermore, since $f_v = f_o/N$, the divisor, N , is changed by program code input so that $N = 980/10 - 2070/10 = 98 - 207$.

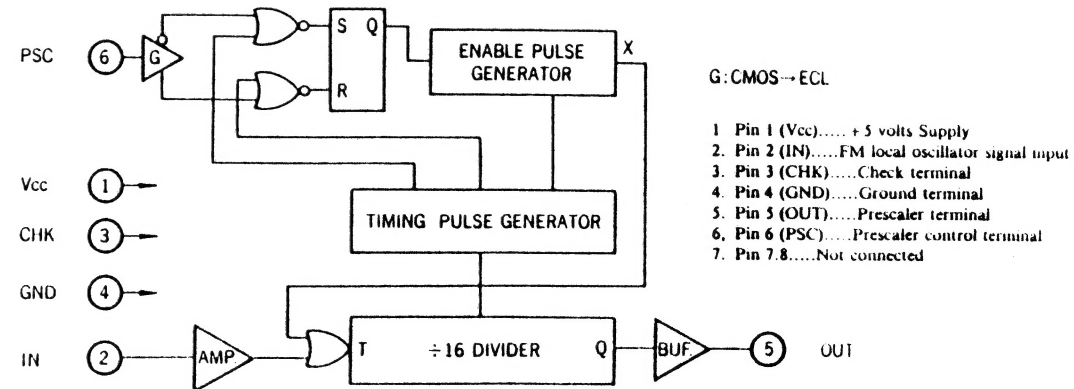
Operation During FM Reception.

The pulse swallow method is used in the prescaler of the T-4017. In this type of prescaler, a supplementary number (changed according to the program code input) and the divided reception frequency from the prescaler are combined in the control counter and the prescaler's division factor is switched between 1/16 and 1/17 according to external control (1/16 when the PSC terminal is "H" and 1/17 when it is "L").

The station oscillation frequency is applied to the programmable divider, but the programmable divider has an upper frequency limit of only 30MHz, so the pulse swallow-type prescaler, which can be used up to 150MHz, is inserted for division to $1/N_p$.

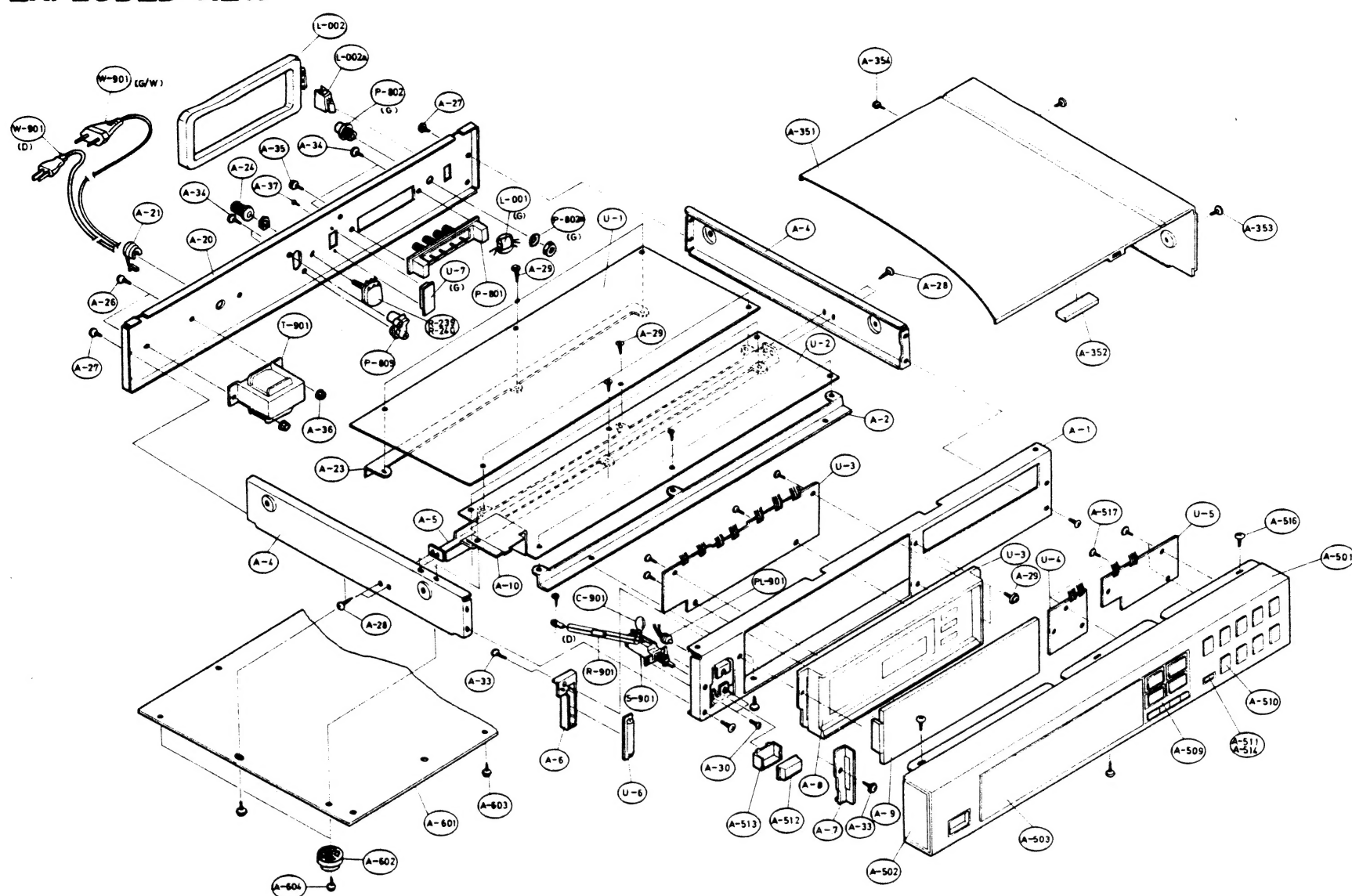
The signal is then divided to 1/2 in the microcomputer and applied to the programmable divider and divided to $1/N$. The result is compared with a 25 kHz frequency standard in the phase detector and the error is output as E_o until a match is obtained as in AM operation.

μPC553AC (Prescaler)



- G: CMOS→ECL
- 1. Pin 1 (Vcc)..... +5 volts Supply
 - 2. Pin 2 (IN)..... FM local oscillator signal input
 - 3. Pin 3 (CHK)..... Check terminal
 - 4. Pin 4 (GND)..... Ground terminal
 - 5. Pin 5 (OUT)..... Prescaler terminal
 - 6. Pin 6 (PSC)..... Prescaler control terminal
 - 7. Pin 7, 8..... Not connected

EXPLODED VIEW



PARTS LIST

REF. NO.	PARTS NO.	DESCRIPTION	REF. NO.	PARTS NO.	DESCRIPTION	REF. NO.	PARTS NO.	DESCRIPTION
A1	27110194B	Front bracket	A507	28140459	Cushion	U1	13098549	NARF-1649, FM/AM tuner and power supply circuit pc board ass'y (D)
A2	27130332	Bracket F	A509	28321106A	Knob ass'y, tuning			
A4	27115014F	Side bracket		28321115A	Knob ass'y, tuning (B)			
A5	27130333	Bracket M	A510	28321069B	Knob ass'y, preset		13104549A	NARF-1649a, FM/AM tuner and power supply circuit pc board ass'y (G)
A6	27190198	Holder, lamp		28321070B	Knob ass'y, preset (B)			
A7	27190197	Holder, dial plate	A511	28321109	Knob, M		13100549B	NARF-1649b, FM/AM tuner and power supply circuit pc board ass'y (W)
A8	28133076A	Back plate		28321110	Knob, M (B)			
A9	28130184A	Dial plate	A512	28321023	Knob, power	U2	13098550	NADG-1650, Digital circuit pc board ass'y (D)
A10	28175073-1	Insulating plate		28321024	Knob, power (B)			
A20	27120489A	Back panel (D)	A513	28320828C	Knob, base		13104550A	NADG-1650a, Digital circuit pc board ass'y (G)
	27120490B	Back panel (G)	A514	27180173	Spring			
	27120491A	Back panel (W)	A516	834430068	3TTS+6B (BC), Tapping screw		13100550B	NADG-1650b, Digital circuit pc board ass'y (W)
A21	270025	SR-3P-4, Strainrelief (D)	A517	833430080	3TTP+8P (BC), Tapping screw	U3	13078551A	NADIS-1651a, Display pc board ass'y
	270280	SR-4K-4, Strainrelief (G/W)	A519	28140486	Cushion	U4	13098552	NASW-1652, Switch pc board ass'y
A23	27140500	Pc bracket B	A601	27170151A	Bottom board	U5	13098553	NASW-1653, Switch pc board ass'y
A24	28320540	Knob, output	A602	27175009A	Leg	U6	13098554	NAPL-1654, Dial plate illumination lamp pc board ass'y
A26	838440089	4TTB+8C (BC), Tapping screw	A603	831430088	3TTW+8B (BC), Tapping screw	U7	13104580	NASW-1680, FM antenna attenuator pc board ass'y (G)
A27	801230	3STS+8BQ (BC), Tapping screw	A604	834430108	3TTS+10B (BC), Tapping screw			
A28	834430068	3TTS+6B (BC), Tapping screw	△C901	3500065A	0.01F, AC400V, Capacitor IS		253083-1	AS-CEE, Power supply cable (G/W)
A29	831430088	3TTW+8B (BC), Tapping screw	△C901a	27300080	Cover, capacitor		253099A	AS-UC-3, Power supply cable (D)
A30	82143006	3P+6FN (BC), Pan head screw	L001	233026A	Balloon transformer (G)			
A31	863430	N-3FN (BC), Nut	L002	232098	NMA3040, AM loop antenna			
A32	82142004	2P+4F (BC), Pan head screw	L002a	27190129	Holder, antenna			
A33	833430080	3TTP+8P (BC), Tapping screw	P801	25060045	NTM4PRMN14, Antenna terminal (D/W)			
A34	834430108	3TTS+10B (BC), Tapping screw		25060047	NTM4PRMN16, Antenna terminal (G)			
A36	86414010	FWN4×10FN, Flange nut						
A37	82141604	2.6P+4F (BC), Pan head screw	P802	25045088	Connector, antenna 75ohm (G)			
A351	28184188	Top cover	P802a	870057	M10B, Toothed washer (G)			
	28184183	Top cover (B)	P803	25045086	NPJ-2PRBL-43, Output terminal			
A352	28140020	14×10×40mm, Cushion	PL901	210149	PL14V60mAW3.0, Power indicator lamp			
A353	838440089	4TTB+8C (BC), Tapping screw						
A354	834430068	3TTS+6B (BC), Tapping screw	R239, R240	5147012	N16G10KB15, Output level adjustment variable resistor			
A501	13098121	Front panel ass'y						
	13078121	Front panel ass'y (B)						
A502	28125137	End cap	△R901	431523355	3.3Mohm, 1/2W, Solid resistor (D)			
	28125138	End cap (B)	△S901	25035135	NPS-111-L100P, Power switch (D)			
A503	28191191	Clear plate		25035322	NPS-111-L286P, Power switch (G/W)			
A504	27267206	Guide, power	△S902	25065123	NSS-1258P, Voltage selector switch (W)			
	27267234	Guide, power (B)						
			△T901	230692	NPT-808D, Power transformer (D)			
				230693	NPT-808G, Power transformer (G)			
				230694	NPT-808DG, Power transformer (W)			

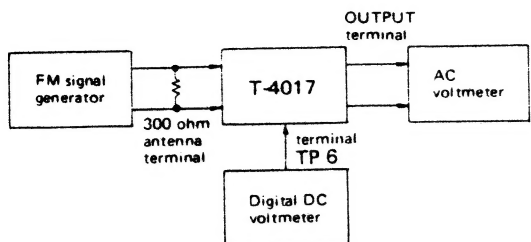
NOTE: THE COMPONENTS IDENTIFIED BY MARK △ ARE CRITICAL FOR RISK OF FIRE AND ELECTRIC SHOCK. REPLACE ONLY WITH PARTS NUMBER SPECIFIED.

Note: (D): Only 120V model
(G): Only 220V model
(W): Only 120/220V model
(B): Only black model

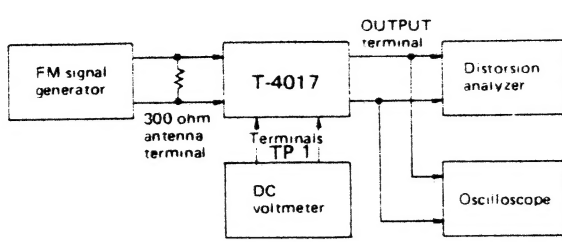
ADJUSTMENT PROCEDURES

FM section

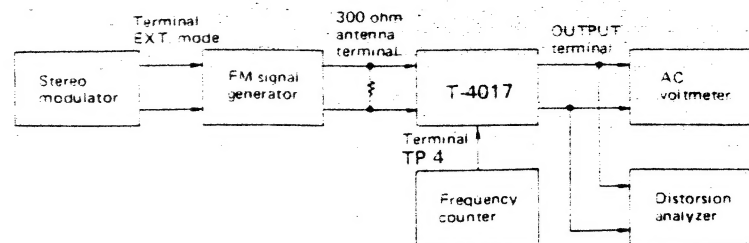
Item	Step	Connection of instrument	FM SG output	Stereo modulator	Tuned frequency	Output indicator	Adjustment	Adjust	Remarks
FM RF	1	Fig. 1		—	107.9MHz	Digital DC voltmeter	TC0	20.8V	
	2		107.9MHz 1kHz 75kHz devi.	—	107.9MHz	AC voltmeter	TC1 to TC3	Maximum	D/W models
							TC1 to TC4		G model
FM IF	1	Fig. 2		—	No input signal	DC voltmeter	L101 primary coil	0V	Repeat the steps 1 and 2 until no further adjustment is necessary.
	2		98.1MHz 65dBf 1kHz 75kHz devi.	—	98.1MHz	Distorsion analyzer	L101 secondary coil	Minimum	
VCO		Fig. 3	98.1MHz 65dBf no modulation	—	98.1MHz	Frequency counter	R217	76kHz+76Hz	Remove the frequency counter after adjustment.
Stereo separation	1	Fig. 3	98.1MHz 65dBf ext. modulation	Lch. 1kHz	98.1MHz	Rch. AC voltmeter	R208	Minimum	Maximum and same separation at the channels left and right.
	2			Rch. 1kHz		Lch. AC voltmeter		Minimum	
Distorsion		Fig. 3	98.1MHz 65dBf ext. modulation	L + R 1kHz	98.1MHz	Distorsion analyzer	IF	Minimum	
Muting level	1	Fig. 2	98.1MHz 17.2dBf	—	98.1MHz	Oscilloscope	R133	Signal is output	Muting switch to on position
	3		98.1MHz 16.2dBf					No output	
NARROW IF level		Fig. 4	98.1MHz 35.2dBf 1kHz 75kHz devi.	—	98.1MHz	DC voltmeter	R118	Same level at the left and right channels.	
LOCAL indication lighting level	1	Fig. 4	98.1MHz 85dBf 1kHz 75kHz devi.	—	98.1MHz	LOCAL indicator	R802	lights on	
	2		98.1MHz 84dBf 1kHz 75kHz devi.					lights off	



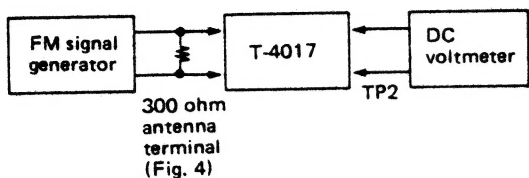
(fig. 1)



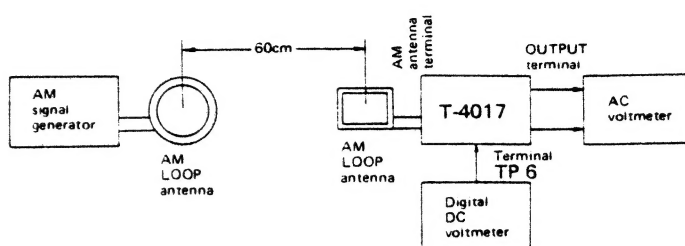
(fig. 2)



(fig. 3)



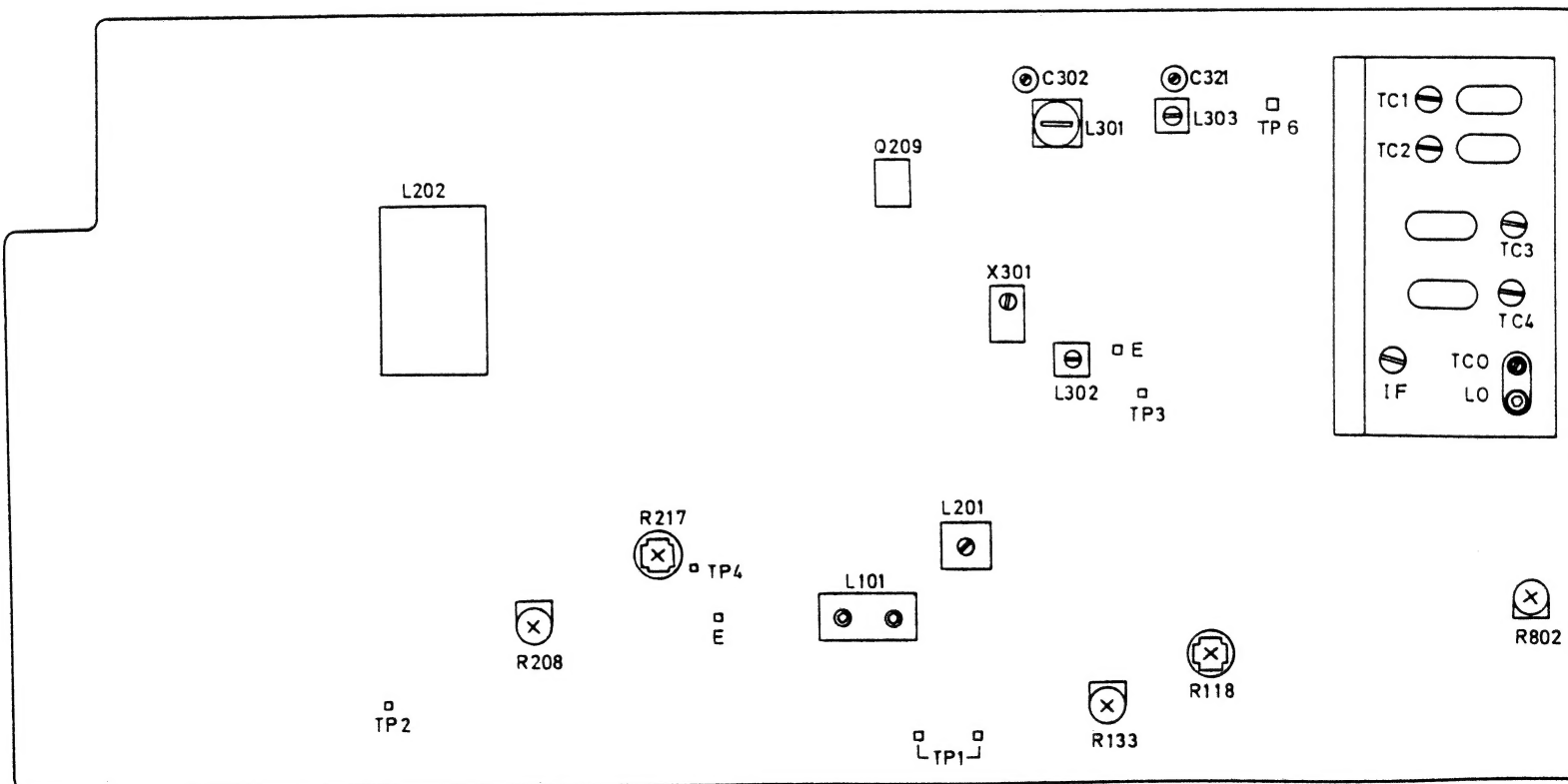
(Fig. 4)



AM section

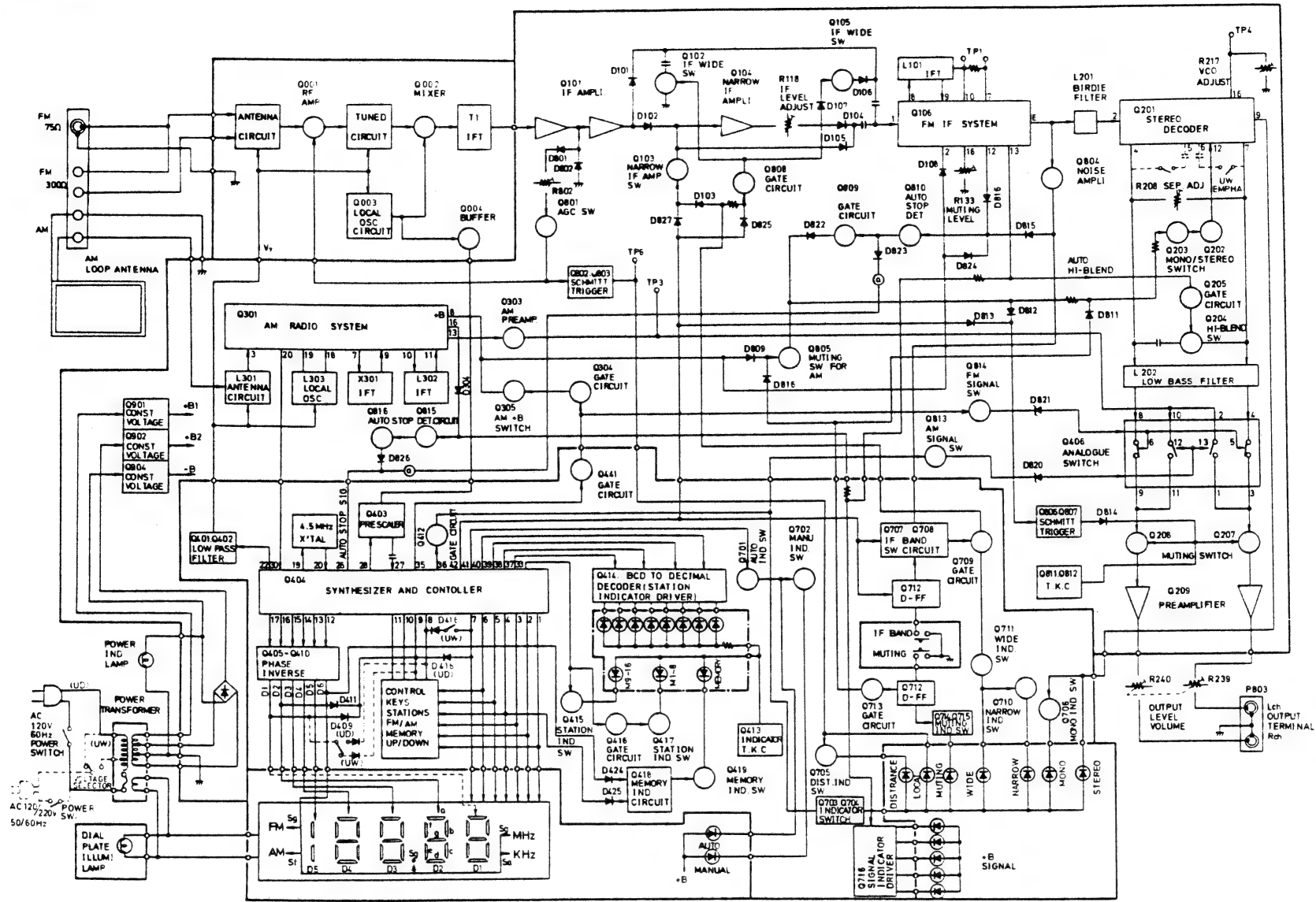
Step	AM SG output	Tuned frequency	Output indicator	Adjustment	Adjust	Remarks
1	999kHz (1000kHz)	999kHz (1000kHz)	AC voltmeter	X301 L302	Maximum	
2		522kHz (520kHz)	Digital DC voltmeter	L303	2.5V	Repeat the steps 2 and 3 until no further adjustment is necessary.
3		1611kHz (1610kHz)		C321	15.5V	
4	603kHz (600kHz) 400Hz 30% mod.	603kHz (600kHz)	AC voltmeter	L301	Maximum	Repeat the steps 4 and 5 until no further adjustment is necessary.
5	1404kHz (1400kHz) 400Hz 30% mod.	1404kHz (1400kHz)	AC voltmeter	C302	Maximum	

Note: () ; 120V model



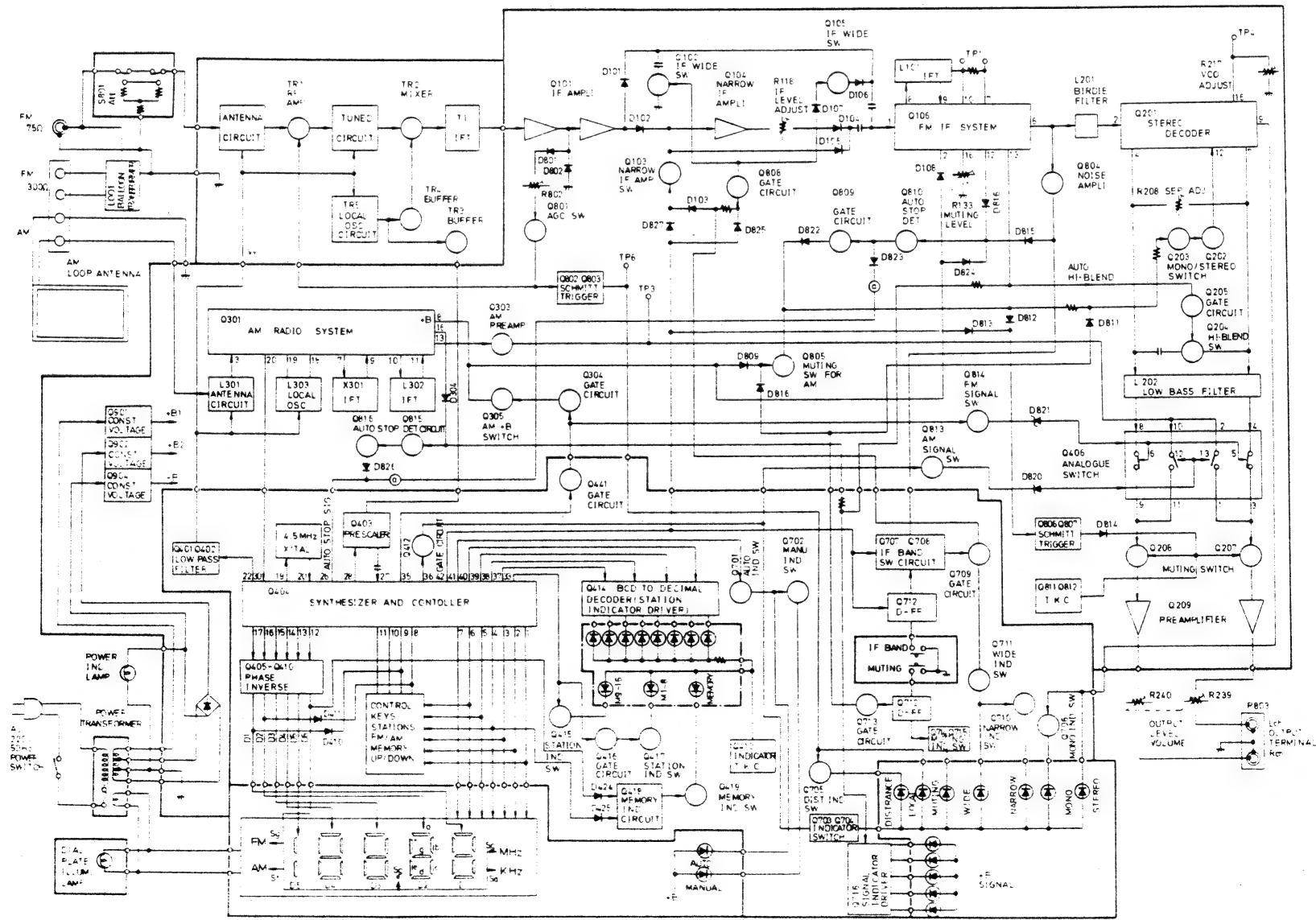
BLOCK DIAGRAM

- 120V/W models -



BLOCK DIAGRAM

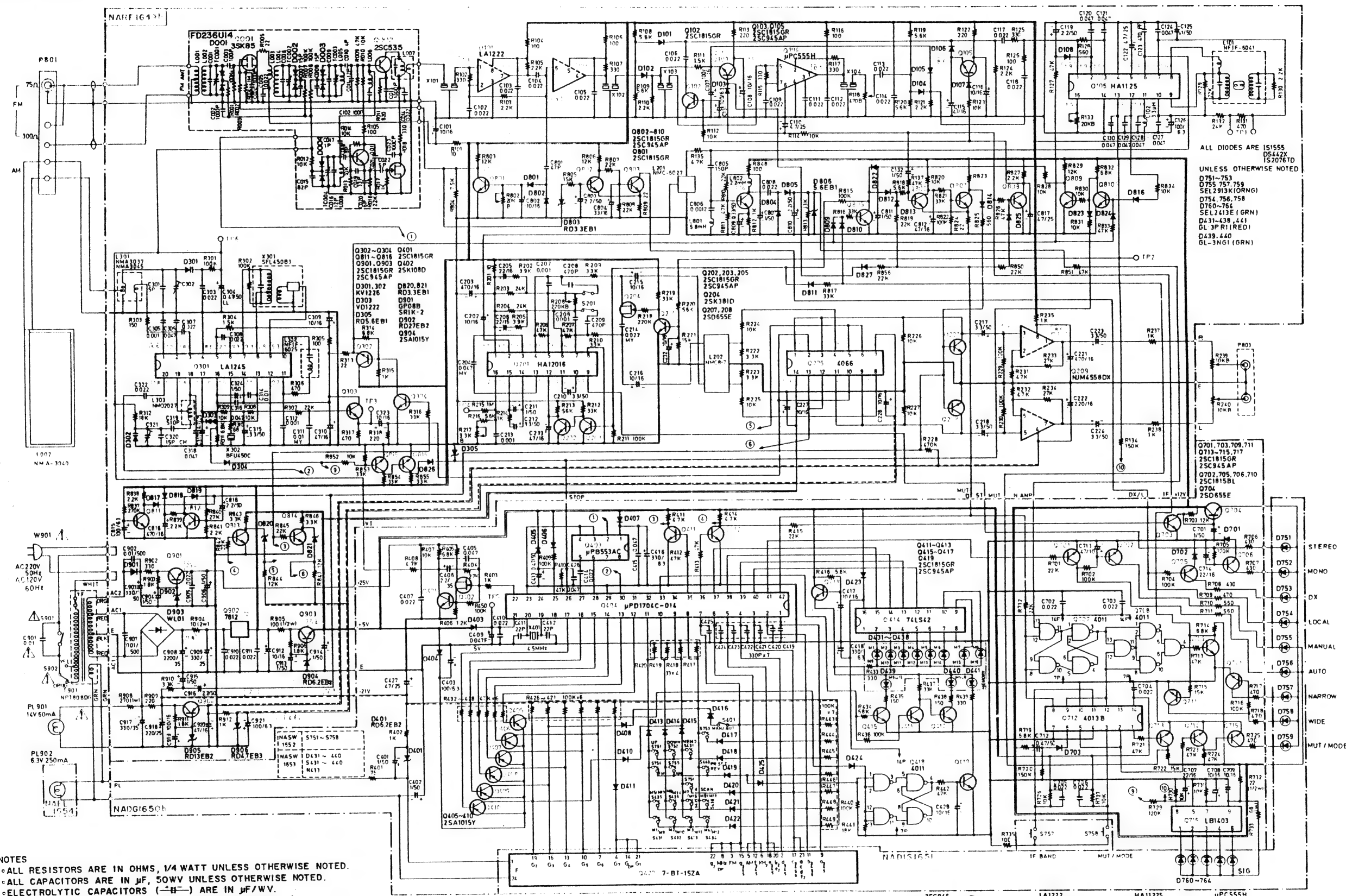
- 220V model -



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SCHEMATIC DIAGRAM

— 120/220V model —

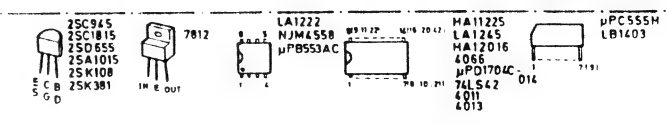


NOTES
 • ALL RESISTORS ARE IN OHMS, 1/4 WATT UNLESS OTHERWISE NOTED.
 • ALL CAPACITORS ARE IN μ F, 50V UNLESS OTHERWISE NOTED.
 • ELECTROLYTIC CAPACITORS (—E—) ARE IN μ F/WV.
 • VOLTAGE (MEASURED WITH V.T.V.M.) (NO INPUT SIGNAL).
 • CIRCUIT IS SUBJECT TO CHANGE FOR IMPROVEMENT.
 • THE COMPONENTS IDENTIFIED BY MARK Δ ARE CRITICAL
 FOR SAFETY REPLACE ONLY WITH PART NUMBER SPACI FIED.

ALL DIODES ARE 1S155
 D5442X
 1S2076D
 UNLESS OTHERWISE NOTED
 D751-753
 D755-757, 759
 SEL2913K (ORNG)
 D754, 756, 758
 D760-764
 SEL2413E (GRN)
 D431-438, 441
 GL3P1 (RED)
 D439, 440
 GL-3NG1 (GRN)

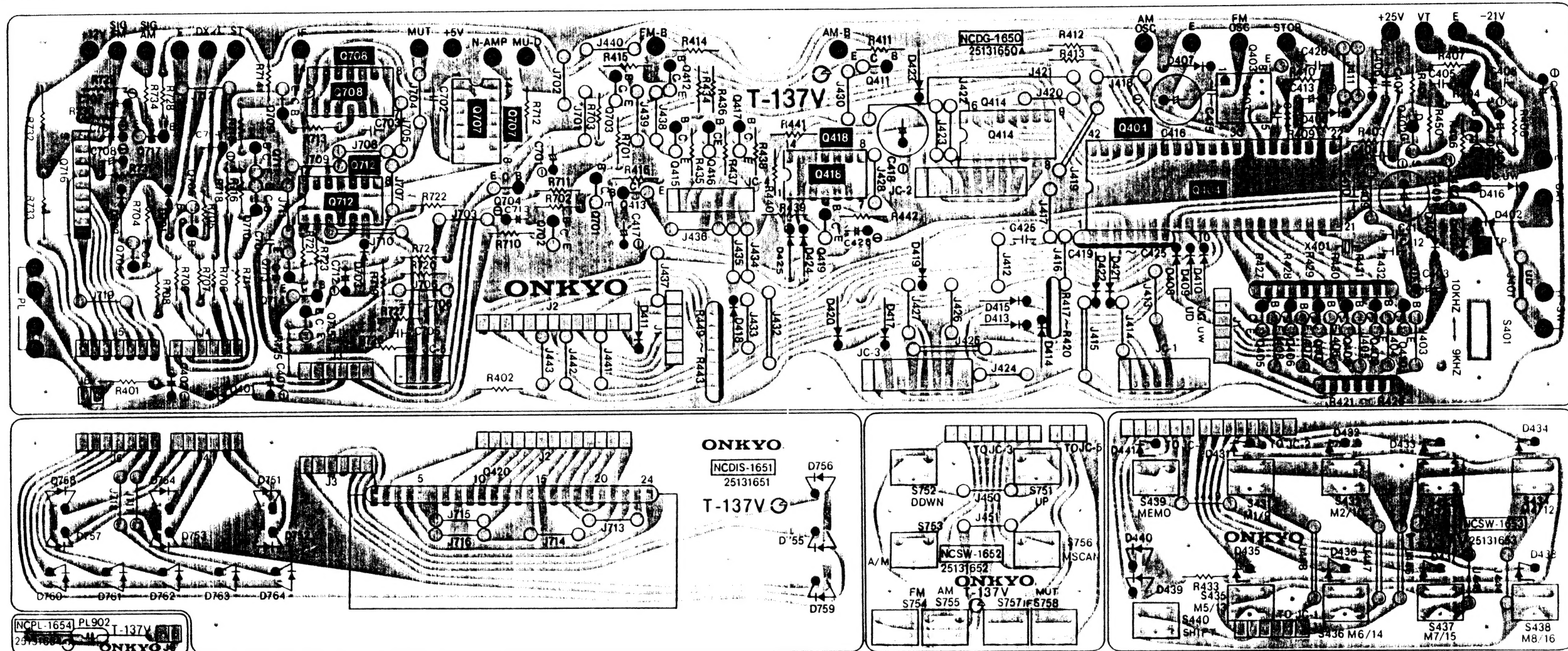
Q701, 703, 709, 711
 Q713-715, 717
 2SC1815GR
 2SC945AP
 Q702, 705, 706, 710
 2SC1815BL
 Q704
 2SD655E

STEREO
 MONO
 DX
 LOCAL
 MANUAL
 AUTO
 NARROW
 WIDE
 MUT / MODE



PC BOARD VIEW FROM COMPONENT SIDE

— Controller, display and switch section —



PC BOARD — PARTS LIST

DIGITAL CIRCUIT PC BOARD ASS'Y (NADG-1650/a/b)

CIRCUIT NO.	PARTS NO.	DESCRIPTION
ICs		
Q403	222619	μ PB553AC, Prescaler
Q404	222702	μ PD1704C-014, Controller
Q414	222740421	74LS42, BCD to decimal decoder
Q418, Q707	222513 or 4011BP	4011BP, NAND gate
Q708	222840111	4013B, D flip-flop
Q712	222840131	LB-1403, Signal strength meter driver
Q716	222666	
Transistors		
Q401	2211255	2SC1815 (GR)
Q402	2212294	2SK108 (D)
Q405-Q410	2211454	2SA1015 (Y)
Q411-Q413	2211255 or 2210746	2SC1815 (GR) or 2SC945A (P)
Q415-Q417	2211255 or 2210746	2SC1815 (GR) or 2SC945A (P)
Q419, Q701	2210746	2SC945A (P)
Q703	2211256	2SC1815 (BL)
Q702	2211705	2SD655 (E)
Q704	2211256	2SC1815 (BL)
Q705, Q706	2211255 or 2210746	2SC1815 (GR) or 2SC945A (P)
Q709, Q711	2211255 or 2210746	2SC1815 (GR) or 2SC945A (P)
Q713-Q715	2210746	2SC945A (P)

CIRCUIT NO.	PARTS NO.	DESCRIPTION
Q710	2211256	2SC1815 (BL)
Diodes		
D401	2239492	RD6.2LB2
D403-D409	223105,	1S1555,
D411	223133 or 223145	DS442X or 1S2076TD (D)
D413-D425	223105,	1S1555,
D403-D408	223105,	1S1555,
D410, D411	223133 or 223145	DS442X or 1S2076TD (G)
D413-D415	223145	1S2076TD (G)
D417-D425	223105,	1S1555,
D403-D408	223133 or 223145	DS442X or 1S2076TD (W)
D410, D411	223105,	1S1555,
D413-D425	223133 or 223145	DS442X or 1S2076TD
D701-D703	223145	1S2076TD
X'tal		
X401	3010052	XTL-4.5M
Capacitors		
C401, C402	352780109	1 μ F, 50V, Elect.
C403	352721019	100 μ F, 6.3V, Elect.
C406	395160227	2.2 μ F, 35V, Tantalum
C409	3020018	0.047F, 5V, Super
C413	352784799	0.47 μ F, 50V, Elect.
C416, C418	352723319	330 μ F, 6.3V, Elect.
C417	352741009	10 μ F, 16V, Elect.
C419-C424	3020024	B8x0.0116-32N Block

CIRCUIT NO.	PARTS NO.	DESCRIPTION
C427	352750479	4.7 μ F, 25V, Elect.
C428	352741009	10 μ F, 16V, Elect.
C701	352780109	1 μ F, 50V, Elect.
C707	352742209	22 μ F, 16V, Elect.
C708, C709	352741009	10 μ F, 16V, Elect.
C712	352784799	0.47 μ F, 50V, Elect.
C713	352734709	47 μ F, 10V, Elect.
C714	352742209	22 μ F, 16V, Elect.
Resistors		
R417-R420	49121333504	33k Ω mx4, 1/8W, Network
R421-R426	49121104506	100k Ω mx6, 1/8W, Network
R427-R432	49241473506	470 Ω mx6, 1/8W, Network
R443-R449	49121104507	100 Ω mx7, 1/8W, Network
R732	441522204	220 Ω m, 1/2W, Metal oxide film
R733	441626804	680 Ω m, 1W, Metal oxide film
Switch		
S401	250142	NSS-2225, Scan step, slide (W)

DISPLAY PC BOARD ASS'Y (NADIS-1651a)

CIRCUIT NO.	PARTS NO.	DESCRIPTION
Q420	212018	7-BT-152A, Fluorescent display tube
D751-D753	225142	SEL2913K, LED

-23-

-24-

FM ANTENNA ATTENUATOR PC BOARD ASS'Y (NASW-1680)

CIRCUIT NO.	PARTS NO.	DESCRIPTION
D754, D756	225137	SEL2413E, LED
D755, D757	225142	SEL2913K, LED
D758	225137	SEL2413E, LED
D759	225142	SEL2913K, LED
S760-D764	225137	SEL2413K, LED
	27190208A	Holder
	28140433	18x6x60mm, Cushion

SWITCH PC BOARDS ASS'Y (NASW-1652/1653)

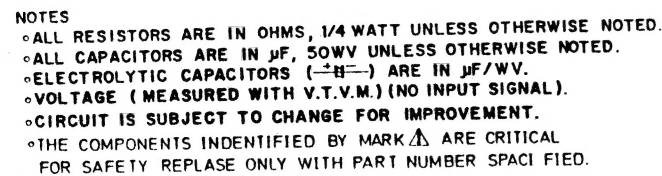
CIRCUIT NO.	PARTS NO.	DESCRIPTION
S751-S758	(NASW-1652) 25035275	NPS-111-S239, Switch
	(NASW-1653)	
D431-D438	225126	GL-3PR1, LED
D439, D440	225134	GL-3NG1, LED
D441	225126	GL-3PR1, LED
S431-S440	25035275	NPS-111-S239, Switch

DIAL PLATE ILLUMINATION LAMP PC BOARD ASS'Y (NAPL-1654)

CIRCUIT NO.	PARTS NO.	DESCRIPTION
PL902	210064A	PL6.3V0.25A, Lamp

Note: 1. D; Only 120V model
G; Only 220V model
W; Only 120/220V model
2. NASW-1680 is used only with 220V model.

— 220V Model —

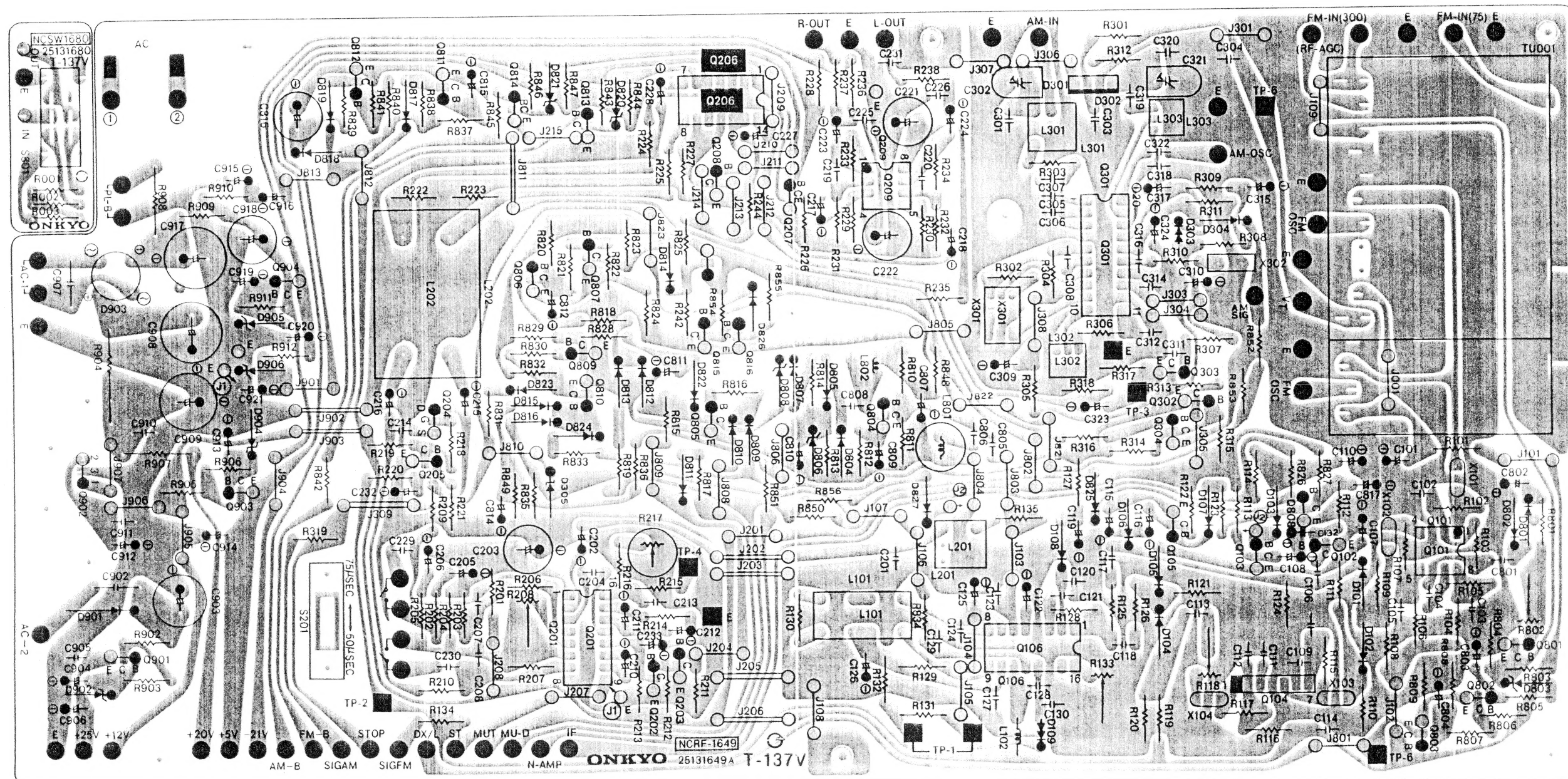


T-4017

T-4017

PC BOARD VIEW FROM COMPONENT SIDE

— FM/AM tuner section —



PRINTED CIRCUIT BOARD — PARTS LIST

FM/AM TUNER AND POWER SUPPLY CIRCUIT PC BOARD (NARF-1649/a/b)

CIRCUIT NO.	PARTS NO.	DESCRIPTION	CIRCUIT NO.	PARTS NO.	DESCRIPTION
TU001	Front end		X101, X102	Ceramic filters	
	240043A	FD236U14A (D/W)		3010024	SFE10.7ML-A (D/W)
	240062	FD636U (G)	X101	3010006	SFE10.7MA (RED) (G)
	ICs		X102	3010024	SFE10.7MA-A (G)
Q101	222577	LA1222, FM IF amplifier	X103, X104	3010070	SFE10.7MS3GY-A
Q104	222591	μPC555H, FM IF amplifier	X301	3010075	SFL450B3
Q106	222540	HA11225, FM IF system	X302	3010076	BFU450C
Q201	222593	HA12016, Stereo decoder		Capacitors	
Q206	222575 or	TC4066BP or	C101	352741009	10μF, 16V, Elect.
	222840661	4066BP, Analogue switch	C107	352741019	100μF, 16V, Elect.
Q209	222502	NJM4558DX, Preamplifier	C110	352750479	4.7μF, 25V, Elect.
Q301	222701	LA1245, AM radio system	C115	352744709	47μF, 16V, Elect.
Q902	222780120	7812, Constant voltage, +12V	C116	352741009	10μF, 16V, Elect.
	Transistors		C119	352780229	2.2μF, 50V, Elect.
Q102	2211255	2SC1815 (GR)	C122	352750479	4.7μF, 25V, Elect.
Q103, Q105	2211255 or	2SC1815 (GR) or	C125	352780109	1μF, 50V, Elect.
Q202, Q203	2210746	2SC945A (P)	C126, C131	352721019	100μF, 6.3V, Elect.
Q204	2212304	2SK381 (D)	C132	352780109	1μF, 50V, Elect.
Q205	2211255 or	2SC1815 (GR) or	C202	352741009	10μF, 16V, Elect.
	2210746	2SC945A (P)	C203	352744719	470μF, 16V, Elect.
Q207, Q208	2211705	2SD655 (E)	C205, C206	352742209	22μF, 16V, Elect.
Q302-Q304	2211255 or	2SC1815 (GR) or	C210	352780339	3.3μF, 50V, Elect.
	2210746	2SC945A (P)	C211	352780109	1μF, 50V, Elect.
Q801	2211255	2SC1815 (GR)	C212	352780339	3.3μF, 50V, Elect.
Q802-Q816	2211255 or	2SC1815 (GR) or	C213	370131024	1,000pF±5%, 100V, APS
Q901, Q903	2210746	2SC945A (P)	C215, C216	352741009	10μF, 16V, Elect.
Q904	2211454	2SA1015 (Y)	C217, C218	352780339	3.3μF, 50V, Elect.
	Diodes		C221	352744719	470μF, 16V, Elect.
D101-D108	223105,	1S1555,	C222	352742219	220μF, 16V, Elect.
D304	223133 or	DS442X or	C223, C224	352780339	3.3μF, 50V, Elect.
D801, D802	223145	1S2076TD	C227, C228	352741009	10μF, 16V, Elect.
D301, D302	223136	KV1226	C229, C230	370134714	470pF±5%, 100V, APS (W)
D303	4000068	VD1222	C232	352741009	10μF, 16V, Elect.
D305, D806	2239471	RD5.6EB1	C233	352744709	47μF, 16V, Elect.
D803	2241291	RD3.3EB1	C302	3060010	NTC-20P09, Trimmer
D804, D805	223105,	1S1555,	C304	392884797	0.47μF, 50V, LL
D809-D814	223133 or	DS442X or	C309	352741009	10μF, 16V, Elect.
D816-D819	223145	1S2076TD	C310	352744709	47μF, 16V, Elect.
D822-D827	223105,	1S1555,	C315	352780339	3.3μF, 50V, Elect.
	223133 or	DS442X or	C317	352750479	4.7μF, 25V, Elect.
	223145	1S2076TD	C319	370135114	510pF±5%, 100V, APS
D820-D821	2241291	RD3.3EB1	C321	3060010	NTC-20P09, Trimmer
D901	223848 or	GP08B or	C323	352741009	10μF, 16V, Elect.
	223804	SR1K-2	C324	352780109	1μF, 50V, Elect.
D902	2239792	RD27EB2	C802	352741009	10μF, 16V, Elect.
D903	223862	WL01	C803	352780229	2.2μF, 50V, Elect.
D904	2239492	RD6.2EB2	C804	352743309	33μF, 16V, Elect.
D905	2239652	RD13EB2	C807	352780109	1μF, 50V, Elect.
D906	2239433	RD4.7EB3	C809	352783399	0.33μF, 50V, Elect.
	Transformers		C810	352780229	2.2μF, 50V, Elect.
L101	233274	NFIF-6041	C811	352780109	1μF, 50V, Elect.
L302	232095	NFIF-6025	C812	352744709	47μF, 16V, Elect.
	Coils		C815	352721019	100μF, 6.3V, Elect.
L102	233105 or	NCCH-1005 or	C816	352744719	470μF, 16V, Elect.
	233024	NCCH-1501	C817	352750479	4.7μF, 25V, Elect.
L201	233236	NMC-6027	C818	352780229	2.2μF, 50V, Elect.
L202	233032A	NMC-8-7	C903	352783319	330μF, 50V, Elect.
L301	232089 or	NMA-3037 or	C904, C906	352780108	1μF, 50V, Elect.
	232107	NMA-3045	C908	352762229	2,200μF, 35V, Elect.
L303	232110	NMO-4027	C909	352753319	330μF, 25V, Elect.
L801	233122	NCH-3013	C912	352741009	10μF, 16V, Elect.
L802	233031	NMC-9-1	C913-C915	352780109	1μF, 50V, Elect.
			C916	352780229	2.2μF, 50V, Elect.

CIRCUIT NO.	PARTS NO.	DESCRIPTION
C917	352763319	330μF, 35V, Elect.
C918	352752219	220μF, 25V, Elect.
C919	352741019	100μF, 16V, Elect.
C920	352744709	47μF, 16V, Elect.
C921	352721019	100μF, 6.3V, Elect.
	Resistors	
R118	5225026	N10HR470BD, Semi-fixed, narrow IF level adjustment
R133	5215003	N08HR20KBC, Semi-fixed, muting level adjustment
R208	5215046	N08HR50KBC, Semi-fixed, VCO adjustment
R217	5225029	N10HR3.3KBC, Semi-fixed, separation adjustment
R802	5215003	N08HR20KBC, Semo-fixed, AGC level adjustment
R904	441721004	10ohm, 2W, Metal oxide film
R905	442521014	100ohm, 1/2W, Metal oxide film
R908	441622714	270ohm, 1W, Metal oxide film
	Radiator	
	27160021	RAD-06B, for Q902
	Switch	
S201	250142	NSS-2225, De-emphasis slide (W)

(D): Only 120V model
(G): Only 220V model
(W): Only 120/220V model

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